

What is claimed is:

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1 [0079] 1. A scanner for reading computer-readable codes, the scanner
2 comprising:
3 an imaging camera configured to produce an image of a computer-readable
4 code from a surface;
5 a shroud at least partially surrounding the imaging camera and configured to
6 exclude ambient light from entering the imaging camera when the scanner is held against the
7 surface; and
8 an illumination lamp disposed within the shroud to illuminate the computer-
9 readable code at an angle such that light from the illumination lamp is not directly reflected
10 from the surface to the imaging camera.

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1 [0080] 2. The scanner of claim 1 wherein the imaging camera has a
2 spectral response variation of less than 25% from about 400 nm to about 700 nm.

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1 [0081] 3. The scanner of claim 1 wherein the imaging camera is a
2 photopic imaging camera.

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1 [0082] 4. The scanner of claim 3 further comprising an optical filter
2 disposed between the imaging camera and the surface, the optical filter transmitting relatively
3 more blue and red light than green light to the imaging camera.

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1 [0083] 5. The scanner of claim 1 wherein the shroud is configured to
2 place the scanner at a selected angle relative to the surface when the scanner is held against
3 the surface.

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1 [0084] 6. The scanner of claim 1 wherein the imaging camera is disposed
2 a distance d from the surface and has a camera imaging area with an image width of $2s$, the
3 imaging area having a first edge and an opposite edge, wherein the illumination lamp is
4 disposed beyond, relative to the imaging camera, a limit line extending from the first edge or
5 the opposite edge at an angle from normal to the surface, the angle being greater than the
6 inverse tangent of $s/2d$.

1 [0085] 7. The scanner of claim 6 wherein the angle is greater than 13

2 degrees.

1 [0086] 8. The scanner of claim 1 further comprising a photodiode.

1 [0087] 9. A scanner for reading computer-readable codes, the scanner

2 comprising:

3 an imaging camera configured to produce an image of a computer-readable
4 code from a surface;

5 a shroud at least partially surrounding the imaging camera and configured to
6 exclude ambient light from entering the imaging camera when the scanner is held against the
7 surface and to hold the imaging camera in a selected relation to the surface;

8 a photodiode disposed within the shroud; and

9 an illumination lamp disposed within the shroud beyond, relative to the
10 imaging camera, a limit line extending from an edge of a imaging region at an angle of
11 inverse tangent $s/2d$ wherein s is one-half the width of the imaging region and d is the
12 distance of the camera from the surface..

521 > [0088] 10. A method of scanning an image of computer-readable code

2 from an electronic display, the method comprising:

3 providing a scanner with a photodetector and an illumination lamp in the off
4 condition, then;

5 measuring light from the electronic display with the photodetector, and, if the
6 measured light is below a selected threshold;

7 turning on the illumination lamp; and

8 scanning the image of the computer-readable code from the electronic display.

1 [0089] 11. The method of claim 10 wherein the photodetector is a
2 photodiode.

1 [0090] 12. The method of claim 10 wherein the photodetector is an
2 imaging camera.

1 [0091] 13. The method of claim 10 wherein the electronic display is an
2 emissive display.

1 [0092] 14. The method of claim 10 further comprising steps, after the
2 scanning step, of:
3 evaluating an exposure level of the computer-readable code, and, if the
4 exposure level is outside preselected limits;
5 adjusting an exposure parameter of the scanner; and
6 scanning the image of the computer-readable code from the electronic display.

sub 1 > 1 [0093] 15. A computer-readable medium having computer-executable
2 instructions for performing a method comprising:
3 measuring light from an electronic display with a photodetector, and, if the
4 measured light is below a selected threshold;
5 turning on an illumination lamp; and
6 scanning a computer-readable code from the electronic display.

1 [0094] 16. A method of scanning a barcode from an electronic display
2 with an imaging scanner, the method comprising:
3 measuring a refresh period of the electronic display;
4 setting an exposure time of the imaging scanner according to the measured
5 refresh period.

1 [0095] 17. The method of claim 16 wherein the exposure time is at least
2 twice the refresh period.

1 [0096] 18. The method of claim 16 wherein the exposure time is at least
2 ten times the refresh period.

1 [0097] 19. The method of claim 16 wherein the exposure time is between
2 10-20 times the refresh period.

sub 1 > 1 [0098] 20. The method of claim 16 further comprising steps of
2 capturing an image from the electronic display with the imaging scanner;
3 evaluating the image for an exposure level; and
4 adjusting an exposure parameter of the imaging scanner according to the
5 exposure level.

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[0099]

21. A method of scanning a barcode from an electronic display

with an imaging scanner, the method comprising:

- 3 capturing a first image of the barcode;
- 4 evaluating the first image for an exposure level;
- 5 adjusting an exposure parameter of the imaging scanner according to the
- 6 exposure level;
- 7 capturing a second image of the barcode;
- 8 attempting to decode the second image to obtain barcode information, and if
- 9 the attempting step fails;
- 10 measuring a refresh period of the electronic display;
- 11 setting an exposure time of the imaging scanner according to the measured
- 12 refresh period;
- 13 capturing a third image of the barcode; and
- 14 decoding the third image to obtain barcode information.

[00100]

22. A computer-readable medium having computer-executable

instructions for performing a method of:

- 3 measuring a refresh period of an emissive electronic display;
- 4 setting an exposure time of an imaging scanner according to the
- 5 measured refresh period; and
- 6 imaging a barcode displayed on the emissive electronic display.

[00101]

23. A method of scanning an image of a barcode displayed on an

electronic display with non-square pixels, the method comprising:

- 3 capturing the image of the barcode displayed on the electronic display;
- 4 digitizing the image to create a digitized image;
- 5 providing the digitized image to a processor;
- 6 determining an aspect ratio of a barcode element, and, if the aspect ratio is
- 7 outside of preselected limits;
- 8 scaling the digitized image to create a scaled virtual image with scaled barcode
- 9 elements having aspect ratios within the preselected limits; and
- 10 decoding the scaled virtual image to obtain barcode information.

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[00102] 24. A method of scanning an image of a barcode displayed on an
2 electronic display, the method comprising:
3 capturing the image of the barcode displayed on the electronic display;
4 digitizing the image to create a digitized image;
5 providing the digitized image to a processor;
6 digitally filtering interference patterns from the digitized image to create a
7 filtered image; and
8 decoding the filtered image to obtain barcode information.

1 [00103] 25. The method of claim 24 wherein the electronic display is a
2 color display.

1 [00104] 26. A method of scanning an image of a barcode displayed on an
2 electronic display, the method comprising:
3 evaluating the electronic display to determine if the electronic display is an
4 emissive display;
5 capturing a first image of the barcode with an imaging scanner;
6 evaluating an exposure level to determine if the exposure level is within
7 preselected exposure level limits, and, if the exposure level is not within the preselected
8 exposure level limits;
9 adjusting an exposure parameter of the imaging scanner;
10 capturing a second image of the barcode with the imaging scanner; and
11 decoding the second image of the barcode to obtain barcode information.

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1 [00105] 27. A method of scanning an image of a barcode displayed on an
2 electronic display, the method comprising:
3 evaluating the electronic display to determine if the electronic display is an
4 emissive display;
5 capturing a first image of the barcode with an imaging scanner;
6 evaluating an exposure level to determine if the exposure level is within
7 preselected exposure level limits, and, if the exposure level is not within the preselected
8 exposure level limits;
9 adjusting an exposure parameter of the imaging scanner;

- 10 capturing a second image of the barcode with the imaging scanner;
11 attempting to decode the second image to obtain barcode information, and, if
12 the attempt to decode fails;
13 measuring the electronic display for flickering;
14 determining a flicker period;
15 setting an exposure time according to the flicker period;
16 capturing a third image of the barcode with the imaging scanner; and
17 decoding the third image to obtain barcode information.

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